MEASLES (rubeola)

DISEASE REPORTING

In Washington

Due to widespread use of the two dose series of measles-mumps-rubella (MMR) vaccine, measles is rarely reported in Washington, unless an outbreak occurs. Most cases of measles in the US result following contact with an imported case from areas where measles is still endemic.

DOH receives 1 to 38 reports of measles infections per year. The last measles-associated death occurred in 1990.

Case reporting or inquiries may be addressed to DOH Communicable Disease Epidemiology or to the DOH Immunization Program.

Purpose of reporting and surveillance

- To educate potentially exposed persons about signs and symptoms of disease, thereby facilitating early diagnosis and preventing further transmission.
- To assist in the diagnosis of cases.
- To identify contacts and recommend appropriate preventive measures, including exclusion, use of immune globulin and immunization.
- To identify situations of undervaccination or vaccine failure.

Reporting requirements

- Health care providers: **immediately notifiable to Local Health Jurisdiction**
- Hospitals: **immediately notifiable to Local Health Jurisdiction**
- Laboratories: **immediately notifiable to Local Health Jurisdiction**, specimen submission required
- Local health jurisdictions: **suspected or confirmed cases are immediately notifiable to DOH Communicable Disease Epidemiology: 1-877-539-4344**

CASE DEFINITION FOR SURVEILLANCE

Clinical criteria for diagnosis

An illness characterized by all the following:
- a generalized rash lasting ≥ 3 days
- a temperature ≥ 101.0ºF (≥ 38.3ºC), and
- cough, coryza, or conjunctivitis.

Laboratory criteria for diagnosis

- Positive serologic test for measles immunoglobulin M antibody, or
- Significant rise in measles antibody level by any standard serologic assay, or
- Isolation of measles virus from a clinical specimen.

Case definition

- Probable: a case that meets the clinical case definition, has noncontributory or no serologic or virologic testing, and is not epidemiologically linked to a confirmed case.
- Confirmed: a case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed case. A laboratory-confirmed case does not need to meet the clinical case definition.

  An imported case has its source outside the country or state. Rash onset occurs within 18 days after entering the jurisdiction, and illness cannot be linked to local transmission. Imported cases should be classified as:
  - *International. A case that is imported from another country*
  - *Out-of-State. A case that is imported from another state in the United States. The possibility that a patient was exposed within his or her state of residence should be excluded; therefore, the patient either must have been out of state continuously for the entire period of possible exposure (at least 7–18 days before onset of rash) or have had one of the following types of exposure while out of state: a) face-to-face contact with a person who had either a probable or confirmed case or b) attendance in the same institution as a person who had a case of measles (e.g., in a school, classroom, or day care center).*
  - *Indigenous: a case of measles that is not imported. Cases that are linked to imported cases should be classified as indigenous if the exposure to the imported case occurred in the reporting state. Any case that cannot be proved to be imported should be classified as indigenous.*

A. DESCRIPTION

1. Identification

An acute, highly communicable viral disease with prodromal fever, conjunctivitis, coryza, cough and small spots with white or bluish white centers on an erythematous base on the buccal mucosa (Koplik spots). A characteristic red blotchy rash appears on the third to seventh day; the rash begins on the face, then becomes generalized, lasts 4-7 days, and sometimes ends in brawny desquamation. Leukopenia is common. The disease is more severe in infants and adults than in children. Complications may result from viral replication or bacterial superinfection, and include otitis media, pneumonia, laryngotracheobronchitis (croup), diarrhea and encephalitis.

In the US, during the 1990s, death from measles occurred at a rate of about 2-3/1,000 cases; deaths occur mainly in children under 5 years of age, primarily from pneumonia and occasionally from encephalitis. Measles is a more severe disease in the very young and in malnourished children, in whom it may be associated with hemorrhagic rash, protein losing enteropathy, otitis media, oral sores, dehydration, diarrhea, blindness and severe skin

infections. Children with clinical or subclinical vitamin A deficiency are at particularly high risk. The case-fatality rates in developing countries are estimated to be 3%-5%, but are commonly 10%-30% in some localities. Acute and delayed mortality in infants and children have been documented. In children who are borderline nourished, measles often precipitates acute kwashiorkor and exacerbates vitamin A deficiency, that may lead to blindness. Subacute sclerosing panencephalitis (SSPE) develops very rarely (about 1/100,000) several years after infection; over 50% of SSPE cases have had measles diagnosed in the first 2 years of life.

Diagnosis is usually made on clinical and epidemiologic grounds although laboratory confirmation is preferred. The detection of measles specific IgM antibodies which are present by 3-4 days after rash onset, or a significant rise in antibody concentrations between acute and convalescent sera confirms the diagnosis of measles. Techniques used less commonly include identification of viral antigen in nasopharyngeal mucosal swab by use of FA techniques, or by virus isolation in cell culture from blood or nasopharyngeal swab collected before the fourth day of rash, or urine specimens taken before the eighth day of rash.

2. Infectious Agent

Measles virus, a member of the genus Morbillivirus of the family Paramyxoviridae.

3. Worldwide Occurrence

Prior to widespread immunization, measles was common in childhood, so that more than 90% of people had been infected by age 20; few went through life without an attack. Measles was endemic in large metropolitan communities, and attained epidemic proportion about every second or third year. In smaller communities and areas, outbreaks tended to be more widely spaced and somewhat more severe. With longer intervals between outbreaks, as in the Arctic and some islands, measles outbreaks often involved a large proportion of the population with a high case-fatality rate. With effective childhood immunization programs, measles cases in the US, Canada and other countries (e.g., Finland, the Czech Republic) have dropped by 99% and generally occur in young unimmunized children or older children, adolescents or young adults who have received only one dose of vaccine.

In the US, there was a marked increase in measles incidence during 1989-1991. The majority of cases occurred in unimmunized children, including those under 15 months of age. Also, sustained outbreaks occurred in school populations among the 2%-5% who failed to seroconvert after 1 dose of vaccine. Similar outbreaks have occurred in Canada prior to the adoption of a 2 dose immunization schedule. Since 2 dose immunization schedules have been adopted, measles incidence has declined to record low levels and recent data indicate interruption of endogenous transmission in the US. In Latin America, programs to administer supplemental doses of measles vaccine in regional National Immunization Day campaigns have resulted in the near elimination of measles from most countries. In 1994, the countries of the Western Hemisphere agreed to set a target of

complete elimination of measles transmission by the end of the year 2005. In temperate climates, measles occurs primarily in the late winter and early spring. In tropical climates, measles occurs primarily in the dry season.

4. Reservoir

Humans.

5. Mode of Transmission

Airborne by droplet spread, direct contact with nasal or throat secretions of infected persons, and, less commonly, by articles freshly soiled with nose and throat secretions. Measles is one of the most highly communicable infectious diseases.

6. Incubation period

About 10 days, but may be 7 to 18 days from exposure to onset of fever, usually 14 days until rash appears; rarely as long as 19-21 days. IG given for passive protection later than the third day of the incubation period, may extend the incubation period.

7. Period of communicability

From 1 day before the beginning of the prodromal period (usually about 4 days before rash onset) to 4 days after appearance of the rash; minimal after the second day of rash. The vaccine virus has not been shown to be communicable.

8. Susceptibility and resistance

All persons who have not had the disease or who have not been successfully immunized are susceptible. Acquired immunity after illness is permanent. Infants born to mothers who have had the disease are protected against disease for approximately the first 6-9 months or more, depending on the amount of residual maternal antibody at the time of pregnancy and the rate of antibody degradation. Maternal antibody interferes with response to vaccine. Immunization at 12-15 months induces immunity in 94%-98% of recipients; reimmunization increases immunity levels to about 99%. Children born to mothers with vaccine induced immunity receive less passive antibody, and these infants may become susceptible to measles and require measles immunization at an earlier age than is usually recommended.

B. METHODS OF CONTROL

1. Preventive measures:

a. Public education by health departments and private physicians should encourage measles immunization for all susceptible infants, children, adolescents and young

adults born in 1957 or later. Those for whom vaccine is contraindicated, and unimmunized persons identified more than 72 hours after exposure to measles in families or institutions may be partially or completely protected by IG given within 6 days after exposure.

b. Immunization: Live attenuated measles vaccine is the agent of choice and is indicated for all persons not immune to measles, unless specifically contraindicated (see B1b iii, below). A single injection of live measles vaccine, which is usually combined with other live vaccines (mumps, rubella), can be administered concurrently with other inactivated vaccines or toxoids; it should induce active immunity in 94-98% of susceptible individuals, possibly for life, by producing a mild or inapparent, noncommunicable infection. A second dose of measles vaccine may increase immunity levels to as high as 99%.

   About 5%-15% of nonimmune vaccinees may develop malaise and fever to 39.4°C (103°F) within 5-12 days postimmunization which lasts 1-2 days, but with little disability. Rash, coryza, mild cough and Koplik spots may occasionally occur. Febrile seizures occur infrequently and without sequelae; the highest incidence is in children with a previous history or a close family history (parents or siblings) of seizures. Encephalitis and encephalopathy have been reported following measles immunization (less than one case per million doses distributed).

   To reduce the number of vaccine failures, the current recommendation in the US is a routine 2 dose measles vaccine schedule, with the initial dose administered at 12-15 months of age or as soon as possible thereafter. The second dose should be given at school entry (4-6 years of age), but can be administered as early as 4 weeks after the first dose in settings where the risk of exposure to measles is high. Both doses should generally be given as combined measles, mumps and rubella vaccine (MMR).

   Routine immunization with MMR at 12 months of age is particularly important in areas where measles cases occur. During community outbreaks, the recommended age for immunization using monovalent measles vaccine can be lowered to 6-11 months. A second dose of measles vaccine is then given at 12-15 months and a third dose at school entry.

   Studies in Africa and Latin America indicate that the optimal age for immunization in developing countries depends on the persistence of maternal antibodies in the infant and the increased risk of exposure to measles at a younger age. In most settings, WHO recommends measles immunization at 9 months of age. In Latin America, PAHO now recommends routine immunization at 12 months of age and periodic supplemental National Immunization Day campaigns to prevent outbreaks.

   i. Vaccine shipment and storage: Immunization may not produce protection if the vaccine has been improperly handled or stored. Prior to reconstitution, freeze-dried measles vaccine is relatively stable and can be stored in a freezer or at refrigerator temperatures (2-8ºC; 35.6-46.4ºF) with safety for a year or more. Reconstituted vaccine should be kept at refrigerator temperatures and discarded after 8 hours. Both freeze-dried and reconstituted vaccine should be protected from prolonged exposure to ultraviolet light, which may inactivate the virus.

ii. Reimmunizations: In the US, in addition to routine reimmunization of children entering school, reimmunization should be required of persons entering high school, educational institutions beyond high school, or entering medical care facilities, unless they have a documented history of measles, serologic evidence of measles immunity, or have received 2 doses of measles containing vaccines. In those who received only inactivated measles vaccine, reimmunization may produce more severe reactions, such as local edema and induration, lymphadenopathy and fever, but will protect against the atypical measles syndrome.

iii. Contraindications to the use of live virus vaccines:

1. Patients with primary immune deficiency diseases affecting T-cell function or acquired immune deficiency due to leukemia, lymphoma or generalized malignancy, or therapy with corticosteroids, irradiation, alkylating drugs or antimetabolites, should not receive live virus vaccines. Infection with HIV is not an absolute contraindication. In the US, immunization with MMR can be considered for asymptomatic HIV infected persons without evidence of severe immunosuppression. WHO recommends measles immunization of all infants and children regardless of HIV status because of the greater risk of severe measles in such persons.
2. Patients with severe acute illness with or without fever should have immunization deferred until they have recovered from the acute phase of their illness; minor febrile illnesses, such as diarrhea or upper respiratory infections, are not a contraindication.
3. Persons with anaphylactic hypersensitivity to a previous dose of measles vaccine, gelatin or neomycin should not receive measles vaccine. Egg allergy, even if anaphylactic, is no longer considered a contraindication.
4. Pregnancy. Purely on theoretical grounds, vaccine should not be given to pregnant women; others should be advised of the theoretical risk of fetal damage if they become pregnant within 1 month after receipt of monovalent measles vaccine or 3 months after receipt of MMR vaccine.
5. Vaccine should be given at least 14 days before IG or blood transfusion. IG or blood products can interfere with the response to measles vaccine for varying periods depending on the dose of IG. The usual dose administered for hepatitis A prevention can interfere for 3 months; very large doses of intravenous IG can interfere for up to 11 months.

c. The requirement for measles immunization for school attendance-from day care centers through college-is an important and effective means of measles control in the US and some provinces of Canada. Since sustained outbreaks have occurred in schools with immunization rates more than 95%, even higher levels of immunity are needed to prevent outbreaks from occurring. This may be achieved by routine reimmunization as a school entry requirement.

2. Control of patient, contacts and the immediate environment:

a. Report to local health authority. Early reporting (within 24 hours) provides opportunity for better outbreak control.

b. Isolation: Impractical in the community at large; children with measles should be kept out of school for 4 days after appearance of the rash. In hospitals, respiratory isolation from onset of catarrhal stage of the prodromal period through fourth day of rash reduces the exposure of other patients at high risk.
c. Concurrent disinfection: None.
d. Quarantine: Usually impractical. Quarantine of institutions, wards or dormitories can sometimes be of value; strict segregation of infants if measles occurs in an institution.
e. Immunization of contacts: Live virus vaccine, if given within 72 hours of exposure, may provide protection. IG may be used within 6 days of exposure for susceptible household or other contacts for whom risk of complications is very high (particularly contacts under 1 year of age, pregnant women or immunocompromised persons), or for whom measles vaccine is contraindicated. The dose is 0.25 ml/kg (0.11 ml/lb) up to a maximum of 15 ml. For immunocompromised persons, 0.5 ml/kg is given, up to a maximum of 15 ml. Live measles vaccine should be given 5-6 months later to those for whom vaccine is not contraindicated.
f. Investigation of contacts and source of infection: A search for and immunization of exposed susceptible contacts should be carried out to limit the spread of disease. Carriers are unknown.
g. Specific treatment: None.

3. Epidemic measures

a. Prompt reporting (within 24 hours) of suspected cases and comprehensive immunization programs for all susceptibles are needed to limit spread. In day care, school and college outbreaks in the US, all persons without documentation of 2 doses of live virus vaccine at least 1 month apart on or after the first birthday should be immunized unless they have documentation of prior physician diagnosed measles or laboratory evidence of immunity.
b. In institutional outbreaks, new admissions should receive vaccine or IG.
c. In many less developed countries, measles has a relatively high case-fatality rate. If vaccine is available, prompt use at the beginning of an epidemic is essential to limit spread; if vaccine supply is limited, priority should be given to young children for whom the risk is greatest.

4. International measures

None.